WHAT IS CLAIMED IS:

1. A marker structure on a substrate for optical alignment of the substrate, the marker structure comprising:

a plurality of first structural elements; and

a plurality of second structural elements, the marker structure capable of directing light incident thereon to a sensor for determining alignment information, the alignment information comprising information relating to a position of the substrate; wherein the first structural element has a first reflecting surface on a first level and a second reflecting surface on a second level lower than the first level, the second structural element being substantially non-reflecting, a separation between the first and second reflecting surfaces determining a phase depth condition for the detected light, and a recess provided in the second reflecting surface to modify the phase depth condition.

2. A marker structure according to claim 1, wherein the first and the second structural elements are arranged to form a diffraction grating, the first structural elements being lines of the grating and the second structural elements being spaces of the grating.

3. A marker structure according to claim 1, wherein the first structural elements comprise a metal.

4. A marker structure according to claim 1, wherein the second structural elements comprise a dielectric.

5. A marker structure according to claim 1, wherein the recess is present under a portion of the marker structure.

6. A marker structure according to claim 1, wherein the recess is created as a partial recess, the partial recess substantially being located under each of the second structural elements.

7. A marker structure according to claim 1, wherein the recess is created as a partial recess, the partial recess substantially being located under each of the first structural elements.

8. A marker structure according to claim 3, wherein the metal is copper.

9. A marker structure on a substrate for optical alignment of the substrate, the marker structure comprising:

a plurality of first structural elements; and

a plurality of second structural elements, the marker structure capable of directing light incident thereon to a sensor for determining alignment information, the alignment information comprising information relating to a position of the substrate, wherein the first structural element has a first reflecting surface on a first level and a second reflecting surface on a second level

lower than the first level, the second structural element is substantially non-reflecting, a separation between the first and second reflecting surfaces determines a phase depth condition for the detected light, and the second reflecting surface comprises a plurality of additional structural elements located above an opaque layer.

10. A marker structure according to claim 9, wherein the first and the second structural elements are arranged to form a first diffraction grating, the first structural elements being lines of the grating and the second structural elements being spaces of the grating, and the additional structural elements are arranged as lines of a second diffraction grating, the tone of the second diffraction grating being substantially the reverse of the tone of the first diffraction grating.

11. A marker structure on a substrate for optical alignment of the substrate, comprising:

a plurality of first structural elements; and

a plurality of second structural elements, wherein the first and the second structural elements are arranged in a repetitive order of one first structural element located adjacent to one second structural element, the marker structure having a periodicity in an ordering direction of the repetitive order, the first structural elements each having a first width in the ordering direction, the second structural elements each having a second width in the ordering direction, the first and second structural elements having a length direction extending perpendicular to the ordering direction, the marker structure capable of diffracting light incident thereon to be received by a sensor for measurement of a diffraction pattern, wherein the marker structure comprises a first periodic structure and a second periodic structure, the second periodic structure is adjacent and parallel to the first periodic structure, the first periodic structure comprises a plurality of the first structural elements of a first material and having a first width and a plurality of the second structural elements of a second material and having a second width, the first and second structural elements are arranged in a repetitive order with the first width being larger than the second width, the second periodic structure comprising a plurality of the first structural elements of the second material and having a third width and a plurality of the second structural elements of the first material and having a fourth width, the first and second structural elements being arranged in a repetitive order, the third width is equal to the first width and the fourth width is equal to the second width, and the first structural elements in the second periodic structure are located adjacent to the first structural elements in the first periodic structure in such a manner that the second periodic structure is complementary to the first periodic structure.

12. A marker structure on a substrate for optical alignment of the substrate, the marker structure comprising:

a plurality of first structural elements; and

a plurality of second structural elements, the marker structure facilitating optical alignment based upon at least one light beam directed on the marker structure to be detected by a sensor, wherein the first structural elements are formed from a first material and the second structural elements are formed from a second material, the first and second structural elements being arranged in a complementary configuration such that in the absence of asymmetric damage to the first and second structural elements, a first signal is detected at the sensor and in the presence of asymmetric damage to the first and second structural elements a second signal is detected at the sensor.

13. A marker structure according to claim 12, wherein the first signal is a zero or minimum intensity signal, and the second signal is a larger intensity signal.

14. A marker structure according to claim 11 or 12, wherein the first material is conductor material and the second material is either a semiconductor or insulator material.

15. A marker structure according to claim 14, wherein the first material is copper and the second material is a dielectric material.

16. A marker structure on a substrate for optical alignment of the substrate, the marker structure comprising:

a plurality of first structural elements; and

a plurality of second structural elements, the marker structure facilitating optical alignment based upon at least one light beam directed on the marker structure to be detected by a sensor, wherein the marker structure is present in a metallization layer of the substrate, at least one of the the first structural elements includes a first surface area portion having a first surface state and at least one of the the second structural elements includes a second surface area portion having a second surface state, the first surface area portion is related to a first buried marker element, and the second surface area portion is related to a second buried marker element, the first and the second surface states are related to variations in morphology of the metallization layer being induced by the first buried marker element and the second buried marker element, respectively.

17. A marker structure according to claim 16, wherein the first and the second structural elements are arranged to form a diffraction grating.

18. A marker structure according to claim 16, wherein the metallization layer comprises a metal layer being deposited by a hot metal deposition process in a metallization processing sequence.

19. A marker structure according to claim 16, wherein the metallization layer comprises an aluminium layer.

20. A marker structure according to claim 18, wherein the metallization processing sequence further comprises at least one of a deposition of a Ti adhesion layer, a deposition of a Ti/TiN capping layer and a deposition of a passivation layer.

21. A marker structure on a substrate for optical alignment of the substrate, the marker structure comprising:

a plurality of first structural elements; and

a plurality of second structural elements, the marker structure capable of directing light incident thereon to a sensor, wherein the first structural elements comprise a plurality of primary lines and a plurality of first interposed lines.

22. A marker structure according to claim 21, wherein the first and the second structural elements are arranged to form a diffraction grating.

23. A marker structure according to claim 21, wherein the primary lines comprise a first material and the first interposed lines comprise a second material.

24. A marker structure according to claim 23, wherein the first material has a first resistance to chemical mechanical polishing, the second material has a second resistance to chemical mechanical polishing, and the first resistance is different from the second resistance.

25. A marker structure according to claim 22, wherein the plurality of first interposed lines form a periodic structure.

26. Marker structure according to claim 25, wherein the periodic structure extends in a direction substantially perpendicular to a periodic direction of the diffraction grating.

27. A marker structure according to claim 25, wherein the periodic structure extends in a direction substantially parallel to a periodic direction of the diffraction grating.

28. A marker structure according to claim 26, wherein the second structural element comprises a plurality of secondary lines and a plurality of second interposed lines,
the plurality of second interposed lines forming a further periodic structure in a direction substantially perpendicular to the direction of the periodic structure formed by the plurality of first interposed lines.

29. A marker structure according to claim 21, wherein the primary lines and the first interposed lines have a dimension comparable to a critical feature size of a product device being created on the substrate.

30. Marker structure according to claim 28, wherein the secondary lines and the second interposed lines have a dimension comparable to a critical feature size of a product device being created on the substrate.

31. An alignment method using a marker structure, the method comprising:

providing at least one light beam directed on the marker structure;

detecting light received from the marker structure at a sensor; and

determining alignment information from the detected light, the alignment information comprising information relating to a position of the substrate,

wherein the at least one light beam has a linear polarization extending substantially perpendicular to a direction of a periodic structure formed by the plurality of first interposed lines, or the sensor has a polarization filter which allows transmission of light having that linear polarization.

32. An alignment method using a marker structure, the method comprising

providing at least one light beam directed on the marker structure;

detecting light received from the marker structure at a sensor; and

determining alignment information from the detected light, the alignment information comprising information relating to a position of the substrate, wherein the at least one light beam has a linear polarization extending substantially parallel to a direction of a periodic structure formed by the plurality of first interposed lines, or the sensor has a polarization filter which allows transmission of light having that linear polarization.

33. An alignment method according to claim 31 or 32, wherein two light beams are directed on the marker structure, the light beams have substantially orthogonal linear polarizations and are separately received.

34. A substrate for microelectronic devices comprising at least one marker structure according to claim 1, 9, 11, 12, 16 or 21.

35. A lithographic projection apparatus, comprising:

a radiation system configured to provide a projection beam of radiation;

a support configured to support a patterning device, the patterning device configured to pattern the projection beam according to a desired pattern;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam onto a target portion of the substrate;

a substrate alignment system configured to detect a position of the substrate relative to a position of the patterning device;

the substrate comprising at least one marker structure according to claim 1, 9, 11, 12, 16 or 21.

36. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure including a plurality of first structural elements and a plurality of second structural elements, the marker structure capable of directing light incident thereon to a sensor for determining alignment information, wherein the first structural element has a first reflecting surface on a first level and a second reflecting surface on a second level lower than the first level, the second structural element being substantially non-reflecting, a separation between the first and second reflecting surfaces determining a phase depth condition for the detected light, and a recess provided in the second reflecting surface to modify the phase depth condition; and

determining alignment information from the light received from the marker structure at the sensor.

37. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure including a plurality of first structural elements and a plurality of second structural elements, the marker structure capable of directing light incident thereon to a sensor for determining alignment information, wherein the first structural element has a first reflecting surface on a first level and a second reflecting surface on a second level lower than the first level, the second structural element being substantially non-reflecting, a separation between the first and second reflecting surfaces determining a phase depth condition for detected light, and the second relecting surface comprises a plurality of additional structural elements located above an opaque layer; and

determining alignment information from the light received from the marker structure at the sensor.

38. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure including a plurality of first structural elements and a plurality of second structural elements, wherein the first and the second structural elements are arranged in a repetitive order of one first structural element located adjacent to one second structural element, the marker structure having a periodicity in an ordering direction of the repetitive order, the first structural elements each

having a first width in the ordering direction, the second structural elements each having a second width in the ordering direction, the first and second structural elements having a length direction extending perpendicular to the ordering direction, the marker structure capable of diffracting light incident thereon to be received by a sensor for measurement of a diffraction pattern, wherein the marker structure comprises a first periodic structure and a second periodic structure, the second periodic structure is adjacent and parallel to the first periodic structure, the first periodic structure comprises a plurality of the first structural elements of a first material and having a first width and a plurality of the second structural elements of a second material and having a second width, the first and second structural elements are arranged in a repetitive order with the first width being larger than the second width, the second periodic structure comprising a plurality of the first structural elements of the second material and having a third width and a plurality of the second structural elements of the first material and having a fourth width, the first and second structural elements are arranged in a repetitive order, the third width is equal to the first width and the fourth width is equal to the second width, and the first structural elements in the second periodic structure are located adjacent to the first structural elements in the first periodic structure in such a manner that the second periodic structure is complementary to the first periodic structure; and

determining alignment information from the light received from the marker structure at a sensor.

39. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure including a plurality of first structural elements and a plurality of second structural elements, the marker structure facilitating optical alignment based upon at least one light beam directed on the marker structure to be detected by a sensor, wherein the first structural elements are formed from a first material and the second structural elements are formed from a second material, the first and second structural elements being arranged in a complementary configuration such that in the absence of asymmetric damage to the first and second structural elements, a first signal is detected at the sensor and in the presence of asymmetric damage to the first and second structural elements a second signal is detected at the sensor; and

determining alignment information from the light received from the marker structure at the sensor.

40. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure including a plurality of first structural elements and a plurality of second structural elements, the marker structure facilitating optical alignment based upon at least one light beam directed on the marker structure to be detected by a sensor, wherein the marker structure is present in a metallization layer, the first structural element includes a first surface area portion having a first surface state and the second structural element includes a second surface area portion having a second surface state, the first surface area portion is related to a first buried marker element, and the second surface area portion is related to a second buried marker element, the first and the second surface states are related to variations in morphology of the metallization layer being induced by the first buried marker element and the second buried marker element, respectively; and

determining alignment information from the light received from the marker structure at the sensor.

41. A method of alignment of a substrate in a lithographic projection apparatus, the method comprising:

providing at least one light beam directed on a marker structure, the marker structure capable of directing light incident thereon to a sensor, wherein the first structural elements comprise a plurality of primary lines and a plurality of first interposed lines; and

detecting alignment information from the light received from the marker structure at the sensor.